Kitsap County Department of Community Development

Toward a Natural Resources Asset Management Plan for Kitsap County

Workshop Agenda

Date: January 9, 2020
Location: Kitsap County Public Works, 507 Austin Avenue, Port Orchard WA 98366
Meeting Room: Miller Bay Conference Room #109 on the first floor. If you go to the Permit Center on the 2nd floor, staff will escort you to the room.

Goals:
1. Refresh understanding of project goals.
2. Outline the plan of work and roles for year two for the Suquamish Tribe, Port Gamble S'Klallam Tribe, Kitsap County, and Washington Environmental Council.
3. Explore pilot defining levels of service concepts for establishing riparian vegetation asset.
4. Finalize Public Engagement Plan.
5. Introduce funding tool work.

9:15 AM	**Review and Grounding** - Mindy Roberts (WEC), All (30 min) • Overview of the project intent and goals, year 1 activities – Mindy Roberts (WEC), Melia Paguirigan (WEC), Max Webster (WEC) • Updates on interim work between year 1 and year 2 • Year 2 timeline and proposal elements • Q&A *Materials: Year 1 Accomplishments, Year 2 Timeline, Year 2 Proposal*
9:45 AM	**Updates from Partners** (20 mins) • Kitsap County • Suquamish Tribe • Port Gamble S'Klallam Tribe

10:05 AM	**Levels of Service: Riparian Table Top Exercise** - Max Webster (WEC), All (1.5 hours)
	• Run through different current condition scenarios with Max and Dave's mapping work visuals
	    ○ Where is the science on these issues?
	    ○ What do the draft levels of service options look like when map? Do they make sense?
	    ○ What kind of County-level decision making is needed with these levels of service?
	• How should we approach preferred levels of service as a team?
	• Preview shorelines diagram for discussion for how to approach defining levels of service.
	Materials: Riparian Management Zone Lit Review, Shoreline Conceptual Levels of Service

11:35 AM	**Break** (15 min)
11:50 AM	**Public Engagement Plan** – All (40 min) • Discuss proposed plan • Feedback on methods document • Timeline for implementation – when will these be held? • Who needs to be briefed beforehand? Who is leading the scheduling? *Material: Public Engagement Draft Plan*
12:30 PM	**Update on Funding Tool** - Max Webster (WEC) (15 min) • Overview and timeline needs
12:45 PM	**Next Steps** - All (15 min) • Communicating and staying updated
1:00 PM	**Adjourn**

Year 1 Accomplishment Review:

Natural Resources Asset Management Program

- Conducted stakeholder interviews and developed a synthesis to identify the challenges and opportunities for developing a natural resources asset management program *(Stakeholder Interview Synthesis)*

- Researched many examples of related projects to identify where the knowledge gaps were and then developed several in-depth case studies of the most relevant for lessons learned *(Case Studies)*

- Developed a briefing memo of potential levels of service for forest, streams and shorelines to spark initial thoughts and gather feedback *(Level of Service Briefing Memo)*

- Developed a policy document summarizing the political backstops for creating and implementing a natural resources asset management program *(Kitsap County Policy Document)*

- Developed a shared vision amongst project partners for the Kitsap County Natural Resources Asset Management Program *(Workshops)*

- Developed a General Framework and Structural Set-up for natural resources asset management *(General Framework & Structural Set-up Flowchart)*

- Define natural assets and developed extensive lists of ecosystem services and attributes *(Ecosystem service and attribute lists for forests, streams and shoreline)*

- Identified data needs and gathered and cleaned available data; Fit data and framework to Cartegraph software and developed a test ecosystem service index using Chico Creek *(GIS at Work Creating an Ecosystem Services Index to Assess Natural Resources Performance)*

- Potential funding options for natural resources asset management program *(Funding and Financing Sources for Payment for Ecosystem Services)*

- Developed a year 1 report summarizing the work, outlining a general framework and illustrating how we've begun to apply it to Kitsap County *(Year 1 Report)*

Objective/Activity	Description	Who	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20
Year 2														
Objective 1, Activity 1A	Reseach and propose engagement	Melia												
	Engagement input													
	Implement public engaement													
Objective 1, Activity 1B	Branding strategy													
	Communications tools													
Objective 2, Activity 2A	Tribal values	Melia												
Objective 2, Activity 2B	Design and implement LOS	Melia, Max, Mindy, Lisa												
Objective 2, Activity 2C	Consultation workshops		1:1's				Wrkshp						Wrkshop	
Objective 2, Activity 2D	County Commissioner presentations													
										SSEC			Pisces Report?	
Objective 4, Activity 3A	Engage other municipalities with initial products													
Objective 2, Activity 3B	Funding options web portal	Max	Conceptual development							Draft 1			Finalized	
Objective 4, Activity 3C	Tool for sharing with other municipalities													

Overview

This literature review evaluates existing science to inform the establishment proposed levels of service for riparian buffers within the Kitsap County Natural Resource Asset Management Program.

This document in its current form is a discussion draft. It is not meant to provide right or wrong answers but to offer a starting place for a conversation grounded in science about how to identify what ecological thresholds are necessary to be achieved in order to attain net ecological gain, a stated goal of Kitsap County.

The review covers twenty-three primary articles, six scientific synthesizes and two voluntary management standards. In addition to these resources, four Best Available Science reviews commissioned by Puget Sound area local governments and one TMDL were also consulted.

Many of the articles included within this study were initial identified through a review of Best Available Science reports. Others were mainly identified through a search of U.S. Forest Service published research, State Agency research, the WA State Cooperative Monitoring, Evaluation and Research Committee (CMER) and other search engines pertaining to peer-reviewed scientific literature.

Studies included within this review have been filtered for relevance and applicability to Kitsap County. Initially, 81 articles were identified for potential inclusion within this review. This review is limited to those studies with content that is explicitly focused on the effectiveness of riparian management zones within the context of the Pacific Northwest, west of the Cascade Mountains. All of the primary literature cited in this review are comprised of studies which occurred in western Washington, Oregon or British Columbia. In addition, a further screen was applied to prioritize studies which focused on lowland areas where snow melt is not a primary factor influencing stream temperature or water quality. These studies almost exclusively focus on the forested landscape and therefore there are very few which directly consider the effectiveness of riparian management activities in urban or agricultural environments. That is to say, these studies assume that a properly function riparian area within this region is a forested riparian area.

In some cases, these articles directly propose suggested management practices. In others, those recommendations must be inferred through observed impacts to factors such as water quality, in-stream habitat and terrestrial habitat. Once these conclusions were observed and catalogued, they were compared against one another to magnify their findings and to compare and contrast similarities and differences.

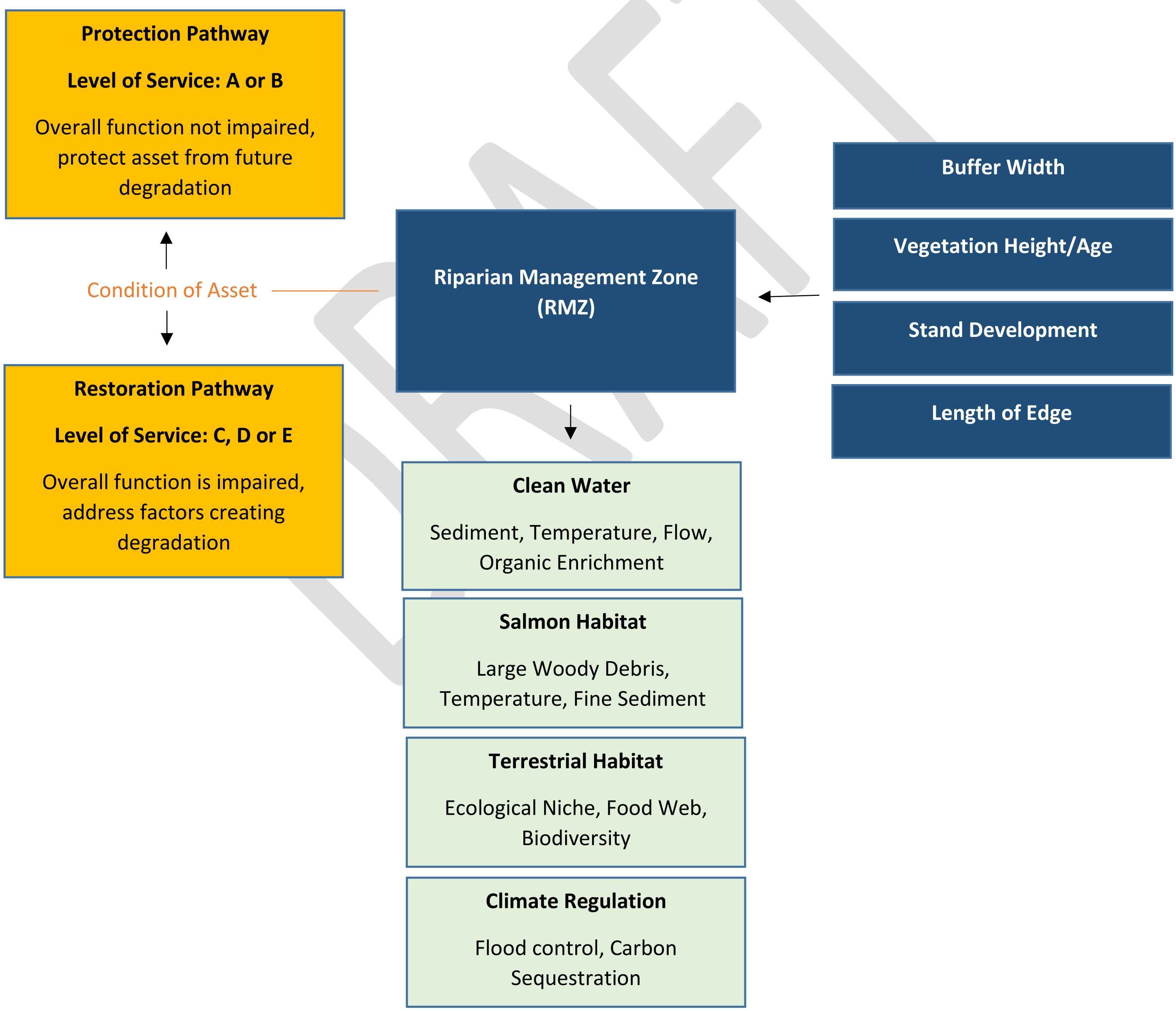
Once these results and conclusions were compared against one another, initial levels of service for discussion were determined for buffer width, vegetation height, forest structure and length of forest edge. These four factors are the primary drivers of riparian function. They are all also landscape factors which can be influenced by management action. For each of these four areas, an index of values which corresponds to expected levels of ecosystem function where determined. These values were then listed under a corresponding level of service.

While the range of values presented here reflects the findings within the scientific literature, some flexibility is provided within each level of service category to respond to allow for uncertainty within the scientific literature. Much of this uncertainty arises from site specific factors which create natural variability in the effectiveness of management interventions. Therefore, the breaks provided for each level of service category reflect a policy choice which can be refined by stakeholders and decision makers.

Some reference is offered for existing regulatory management standards for evaluation against baseline conditions in order to justify actions expected to achieve net ecological gain.

Ultimately, management is only as good as the data you have. The success of this system depends on the quality of data and available information to inform ongoing management decisions. This data will be collected through observations of spatial data sources as well as field surveys in order to provide greater certainty and system accuracy. Next steps for this work include an evaluation of available data and what gaps still exist to effectively implement a system within this level of service framework.

Structural Set-Up for Asset Management of Riparian Management Zones



Proposed Level of Service Recommendations for Riparian Management Zones

Protection Pathway | Restoration Pathway

Buffer Width (Science Synthesis)

	A	B	C	D	E
Feet	246-300+	150-245	98-149	66-97	<65
Meters	75-90+	45-75	31-45	20-30	<20
	Minimal to no impacts to microclimate conditions	90%+ effectiveness for water quality, minimized impacts to terrestrial wildlife	80-90% effectiveness for water quality	70% shade minimum, 80%+ fine sediment control	Expect water temperature increases, increased tree mortality from wind throw

2 SPTH approx. 250 ft — 1 SPTH approx. 125ft
Range of USFS NWFP Buffers

200 ft — 50 ft
Range of DNR Forest Practice Buffer Widths

200 ft — 50 ft
Range of FSC and Salmon Safe Buffer Widths

Vegetation Height/Forest Age (Douglas Fir Class II Site Index)

	A	B	C	D	E
Age	80+	60-79	40-59	20-39	1-20
Feet	195+	170-194	121-169	71-120	1-70
Meters	59+	51-58	37-50	22-36	1-22
	Hydrologic maturity, full recovery from disturbance impacts, approaching old growth	Lessened impacts to summer stream flows	Moderate reduction of summer stream flows	Heavy reduction of summer stream flows	Effective shade (70%+) for small streams, heavy reduction of summer stream flows

FFR Desired Future Conditions Target age 140+

Forest Structure/Stand Development Stage (Oliver & Larson Model)

	A	B	C	D	E
Stand Structure	Old growth/ Multi-aged community	Understory Reinitiation	Stem Exclusion	Stand Initiation	Converted/ Unforested
	Conifer dominated overstory & understory (with natural regeneration), mult-aged		Alder and Hardwood dominated overstory (with natural regeneration), even aged		No - few trees providing riparian shade, impervious area

Protection Pathway

Restoration Pathway

Length of Edge/Fragmentation (Ecology Model)

	A	B	C	D	E
Feet	**<500**	**500-750**	**751-1000**	**1001-1250**	**1250-1500+**
Meters	**<152**	**151-228**	**229-305**	**306-381**	**381-457+**
	Temperature impact <.12C	Temperature impact <.24C	Temperature impact <.36C	Temperature impact <.48C	Temperature impact <.6C

Primary Literature

1) **Andrew, M.E. and Wulder, M.A. (2011) Idiosyncratic responses of Pacific salmon species to land cover, fragmentation, and scale, Ecography, 34: 780-797, 2011**

Through modeling, researchers concluded that changes to forest composition, forest age and fragmentation contributed to salmon population decline on Vancouver Island.

Strong associations were observed between declines in forest cover and increases in forest fragmentation to salmon population decline. Chum and coho were the two species that appeared to be most affected by forest fragmentation. Fragmentation includes both the loss of forested areas to development and the ongoing impacts of timber harvests which fragment historic forest extent through management practices. The study suggests that the persistence and frequency of timber harvests in a watershed has negative effects on salmon populations.

2) **Beshcta, R.L., Bilby, R.E., Brown, G.W., Holtby, B.L. and Hofstra (1987) Stream temperature and Aquatic Habitat. Streamside Management: Forestry and Fishery Interactions. Chapter 6. College of Forest Resources, University of Washington**

Clearcutting along Pacific Northwest streams can increase summertime monthly maximum stream temperatures 3-8 degrees. This points to the relative importance of riparian forest canopy shading for moderating daily maximum temperatures. In an old growth forest, the shading provided by angular canopy density is typically between 80-90%. In old growth streams, net radiation may be as low as 15% of that expected in an unshaded stream.

In order to retain 80-90% shading associated with old growth sites riparian buffers should be a minimum of 30m. Evaluating site dependent factors such as stream aspect, nearby elevation and the subsoil environment is necessary to determine if buffers greater than 30m are necessary.

In an Oregon study, a clearcut stream recovered 50% of effective shade within 15 years of harvest.

3) **Bilby, R.E., and Ward, J.W. (1991) Characteristics and function of large woody debris in streams draining old growth, clear-cut and second-growth forests in southwestern Washington. Can. J. Fish. Aquat. Sci. 48: 2499-2508**

Study examined accumulation of large woody debris (LWD) downstream of old-growth, second growth and recently clear cut sites. LWD accumulation decreases with stream size regardless of stand-age class. However, second growth and recently clearcut sites accumulate less LWD downstream compared with old growth sites. The accumulation of old growth debris volume was 4x greater than the other two observed sites for streams greater than 10m wide.

The composition of woody materially contributed as LWD varies greatly between the three sites. Pool types were most diverse in streams adjacent to old growth forests.

4) **Bisson, P.A., Bilby, R.E, Bryant, M.D., Dolloff, A, Grette, G.B., House, R.A., Murphy, M.L., Koski, K.V. and Sedell, J.R. (1987) Large Woody Debris in Forested Streams in the Pacific Northwest: Past, Present, and Future. Streamside Management: Forestry and Fishery Interactions. Chapter 6. College of Forest Resources, University of Washington**

Overall, debris recruitment is lower in second-growth forests when compared to old growth. In second growth forests, most of the LWD contribution comes from red alder. The rate of contribution from second growth conifers is very slow. In one study, accumulations did not begin to increase until approximately 60-years after timber harvest. When only the riparian management zone (RMZ) can contribute LWD, contributions are expected to be low 40-60 years after harvest.

5) **Brosofske, K.D., Chen, J., Naiman, R.J. and Franklin, J.F. (1997). Harvesting effects on Microclimatic gradients from small streams to uplands in western Washington. Ecological Applications, 7(4), pp. 1188-1200.**

A desire of using riparian buffers in forest management practice is to keep the microclimate surround streams intact following harvests. This study characterized pre and post-harvest microclimate gradients from streams to upland areas across 15 sites in western Washington. In order to mitigate against changes to a riparian area microclimate from edge effects created by a harvest, buffers should be greater than 45m on each side of the stream. Depending on site conditions, this buffer width could need to be extended beyond 300m. The study suggests that many standard buffer widths currently used to protect aquatic resources during timber harvests may not be adequate to protect site microclimate.

6) **Chen, J., Franklin, J.F. and Spies, T.A. (1995) Growing-season microclimatic gradients from clear-cut edges into old-growth Douglas-fir forests. Ecological Applications, 5(1), pp. 74-86**

Edges created by timber harvest activities are an important landscape feature across the Pacific Northwest. Edges created by adjoining timber harvests against old-growth forests create effects that reach into and affect the neighboring microclimate.

Looking at 16 different edges between clear-cuts and old growth forests, edge effects typically extended 30-240m into the neighboring forest. These impacts include increases to air temperature, soil temperature, relative humidity, short-wave radiation and wind speed.

To protect interior species and forest processes, edges should be minimalized. After 50% of the landscape is cut over, no interior forest environments remain that are not impacted by edge effects. Feathered edges rather than hard edges are preferred as a way to mitigate against impacts to site microclimate.

7) **Cristea, N. and Janisch, J. (2007) Modeling the Effects of Riparian Buffer Width on Effective Shade and Stream Temperature. Environmental Assessment Program. Washington State Department of Ecology**

This study evaluates the SHADE model and water quality models used by the Department Ecology to evaluate potential impacts to effective shade as the result of canopy removal. The model evaluated expected change in maximum daily temperature relative to unharvested sites under several different scenarios comparing riparian buffer widths, length of harvest areas and stream size.

The report shows that other research has indicated that buffer widths ranging from 36-142ft are necessary to achieve 60-100% shade depending on site factors. The results of these studies are presented in a table.

The model assumed a riparian area primarily comprised of mature red alder, 80 feet in height, with 85% canopy closure. For streams that are 10ft wide, shading efficiency declined when trees dropped below 5m. In evaluating buffer width on streams of this size, 75ft buffers provided 81-90% of effective shade, 50ft buffers provided 73-86% effective shade and 30ft buffers provided 65-78% effective shade.

For 20ft wide streams, shade efficiency decline when vegetation was shorter than 10m. In evaluating buffer width on streams of this size, a 75ft buffer provided 79-88% of effective shade, 50ft 69-83% and 30ft provided 61-72%.

Overall, buffer width, canopy cover and harvest-unit length (edge) were determined to be the most important controls on stream heating.

8) **Gray, A.N., Whitter, T.R., and Harmon, M.E (2016) Carbon stocks and accumulation rates in Pacific Northwest forests: role of stand age, plant community and productivity, Ecosphere, 7(1):e01224.10.1002/ecs.1224**

Using Forest Inventory Analysis data (FIA), this study examined over 8,700 plots cover 9.1 million hectares of Pacific Northwest forestland. On average, stands accumulated 75% of their maximum potential non-mineral carbon stock by age 127 t/- 35 years based upon species type and site class. For Douglas fir, that estimate is 158yrs t/- 31 and for Western Hemlock communities its 196 +/- 42.

Small trees sequester carbon at higher rates than older trees and are important for rapidly accumulating new carbon. However, most of the carbon storage occurs in large trees and those carbon stores continued to increase throughout the region even as forests aged and stand-level mortality increases.

9) **Groom, J.D., Dent, L., Madsen, L.J., Fleuret, J. (2011) Response of western Oregon (USA) stream temperatures to contemporary forest management, Forest Ecology and Management, 262 (2011), 1618-1629.**

The study examined pre-harvest and post-harvest stream temperatures at 33 sites to evaluate the effectiveness of Oregon's forest practices. In particular, the study regarded leave-tree rules for protecting water quality and salmon habitat. Overall, shade, edge and low gradient were the best predictors of summer stream temperature change.

Reducing shade levels by 50% predicted a maximum daily temperature increase as high as 2 degrees C.

Between 68% and 75% of variability in post-harvest shade may be accounted for by basal area within 30m of the stream. Influencing factors within this 30m buffer include tree height and possible tree blowdown.

10) Groom, J.D., Dent, L., Madsen, Jones, J.E., Giovanni, J.N. (2018) Informing changes to riparian forestry rules with a Bayesian hierarchical model, Forest Ecology and Management, 419-420 (2018), 17-30

The study modeled expected impacts to stream temperature as the result of different buffer sizes based on data collected from forest harvest sites in Oregon. Overall, little in-stream temperature change was expected when buffers were kept at 30m or greater. At 30m, buffers retained almost of all its original shade an under the desired .3 degrees C temperature increase. Buffers between 20-30m were effective at keeping stream temperature increases below 2 degrees C.

11) Janish, J.E., Wondzell, S.M. and Ehinger, W.J. (2011) Headwater stream temperature: Interpreting response after logging, with and without riparian buffers, Washington, USA, Forest and Ecology Management, 270 (2012), 302-313

The study covered a seven-year period and evaluated the results of different buffer applications in 30 catchments in the Willapa Hills and Capital Forest areas of SW Washington. All of the streams analyzed were shallow with low summer flows. The buffer treatments applied were a continuous buffer 15m wide, a patch buffer comprising patches 50-110m long retained within the floodplain and clearcut harvest where no riparian buffer was left behind.

Stream temperatures generally increased after logging for all treatments. Temperature increases were greatest in the clearcuts and smallest in the patch buffered treatments. Still, the temperature effect was lower than expected (3.6 degree C max in clear cut compared to 8 degree max in other studies). Overall, there was variability across catchments for all treatments.

Aspect, length of wetted channel and riparian wetland area were identified as other important factors for determining stream temperature. The greatest post logging temperature increase occurred in northerly facing aspects. Exposed surface water and saturated soils upstream are also a likely contributor.

Generally, substrate was also an important factor. Thermal unresponsiveness generally occurred on coarse-textured substrates v fine-textured substrates. Overall, (K) values are important. Low k values probably indicate more heating. High k, probably indicates more stability and less heating.

12) Jones, J.A. and Post, D.A. (2004) Seasonal and Successional Streamflow Response to forest cutting and regrowth in the northwest and eastern United States, Water Resour. Res., 40, W05203

The study evaluated streamflow response to harvest by evaluating data collected at HJ Andrews Experimental Forest over 40 years. Immediately following harvest, streamflow increased for 1-5 years following 100% canopy removal. In some cases, these increases persisted for a much as 35-years. Streamflow increases were seasonally variant and depended on precipitation levels.

In summer months, streamflow deficits emerged in young recovering forests. This effect was especially pronounced in late summer and early fall. By age 15, August streamflow levels were observed to be 60-80% below pretreatment levels. By age 20-25 previously harvested stands showed summer streamflow deficits of 30-50%. This effect was observed at all treatment sites. The summer deficits likely result from higher water use per unit leaf area among younger forests than older forests. Low summer precipitation across the Pacific Northwest heightens the effect.

13) Latterell, J.J. and Naiman, R.J. (2007) Sources and dynamics of large logs in a temperate floodplain river, Ecological Applications, 17 (4)4, 2007, pp. 1127-1141.

Within the unmodified Queets river system, 95% of logs recruited into the system came from a riparian corridor extending 265m on both banks over a 63-year study period. This recruitment mostly comes from undercutting that occurs along riparian terraces and causes trees to fall into the river.

This study suggests that maintaining corridors of mature forests around floodplains where rivers are allowed to migrate is critical to maintaining LWD inputs In the Queets system, wood recruitment hot spots tended to occur in unconfined alluvial valleys with mature forest in close proximity. These areas should be prioritized for protect for wood recruitment.

14) MacCracken, J.G., Hayes, M.P., Tyson, J.A. and Stebbings, J.L. (2018) Stream-Associated Amphibian Response to Manipulation of Forest Canopy Shading. Cooperative Monitoring Evaluation and Research Report, SAAs and Forest Cover, Washington Department of Natural Resources, Olympia, WA.

Post-harvest treatments at 25 headwater streams across Washington and Oregon were evaluated against pair reference streams. Sites that retained 70% of effective shade saw less than .5 degree C change to the average daily maximum temperature for the stream. Those sites with low shade levels (30%) saw average daily maximum temperature increases of 2 degrees C. Those streams with no shade saw temperature increases of 3-3.5 degrees C.

15) Moore, G.W., Bond, D.J., Jones, J.A., Phillips, N. and Meinzer, F.C. (2004) Structural and compositional controls on transpiration in 40 and 450 year old riparian forests in Western Oregon, Tree Physiology, 24, 481-491.

Overall, young Douglas firs used more water per sapwood area than older Douglas firs. While total basal area is often higher in older forests, sapwood basal area is likely higher in young and recovering forests post disturbance. High levels of sapwood area translate to higher levels of transpiration.

Hardwoods have more sapwood area than conifers. Younger stands of riparian area with more hardwoods would be expected to transpire more than conifers during summer months. The converse is true in the winter when hardwood trees are dormant.

In this study, sapwood basal area was observed to be 21% higher in younger forests when compared to older conifer stands. As a result, estimated per tree water use was 3.27 times higher in the young stand compared to the old stand from mid-summer through early fall. It is suspected that maximum transpiration rates occur between ages 20-60 for conifer stands.

16) **Pearson, S.F. and Manual, D.A. (2001) Breeding bird response to riparian buffer width in managed Pacific Northwest Douglas-fir forests, Ecological Applications, 11(3), pp. 840-853**

Researchers examined impacts from timber harvest activities on breeding bird populations on second and third order streams. Three treatments were employed: unharvested control sites, clearcut sites with a 14m buffer and clearcut sites with a 31m buffer.

On sites that received the narrow 14m buffer treatment, there was high species turnover. While breeding bird populations saw increases along with those that prefer open habitats, resident and upland species declined. Overall, there was no change in overall bird population numbers between the pre-harvest and post harvest riparian sites despite the species transition. Areas that received the 31m buffer saw little changes between pre-harvest and post-harvest populations in terms of both overall numbers and species richness.

Black throated Gray Warbler was the only species whose population numbers declined on both treatment sites. However, its population number seemed to recover with buffers of 45m or greater. To maintain all breeding bird populations post-harvest, the study recommends maintaining minimum buffer widths of 45m.

17) **Perry, T.D. and Jones, J.A. (2017) Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology, 2017, 10e1790.**

Analysis of 60-years of streamflow records in eight paired basins dominated by Douglas fir at HJ Andrews Experimental Forest shows that average daily streamflow in summer was 50% lower in 25-45 year old plantations when compared to reference 150-500 year old forests. This is largely due to higher rates of evapotranspiration among younger trees.

The study also showed that when precipitation levels are high in winter months, young forests yield more water, contributing to increased flooding risk when compared to older forest reference basins.

18) **Pollock, M.M., Beechie, T.J. and Imaki, H. (2012) Using reference conditions in ecosystem restoration: an example for riparian conifer forests in the Pacific Northwest. Ecosphere 3 (11): 98.**

Researchers here identified 117 natural late successional conifer dominated forests across Washington and Oregon to determine reference conditions necessary for describing the structural attributes essential to maintaining biodiversity. These attributes include: abundance of large trees in the overstory, presence of large snags and a well developed understory of shade tolerant species.

Using growth a yield models (FVS) to project future growth, the findings of this study suggest that allowing young forests to grow untouched to age 100 allowed them to reach within one standard deviation of the desired reference conditions. Stands that received a thinning treatment within the growth and yield model did not approach reference conditions within the same period. This is largely because of the impact of overstory removals.

Overall, forest ages of 100+ are likely necessary to achieve the desired conditions for protecting biodiversity within riparian forests.

19) **Reeves, G.H., Benda, L.E., Burnett, K.M., Bisson, P.A. and Sedell, J.R. (1995) A Disturbance-Based Ecosystem Approach to Maintaining and Restoring Freshwater Habitats of Evolutionarily Significant Units of Anadromous Salmonids in the Pacific Northwest, American Fisheries Society Symposium, 17: 334-39.**

Landscapes are dynamic systems. Overtime, landscapes present a mosaic of different habitat types as the result of disturbance. Within natural systems, large disturbance events are episodic and return intervals for events like severe fire, flooding or wind throw can span decades to centuries. These disturbances which have high levels of intensity but which have a long return interval are referenced to as “pulse” disturbance events. Salmon populations are largely evolved to respond to the natural variation created by these kinds of disturbance events.

Human induced disturbances such as timber harvests, urbanization and agriculture create a “press” disturbance events. These events are likely of lower intensity at any given point in time, however, they persist for much longer periods and introduce ongoing stresses to the landscape that inhibit the recovery of natural systems. This recovery can take 100-150 years which is not compatible with many current human disturbance practices.

20) **Reeves, G.H., Pickard, B.R. and Johnson, K.N. (2016) An initial evaluation of potential options for managing riparian reserves of the aquatic conservation strategy of the Northwest Forest Plan, General Technical Report PNW-GTR-937, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station**

Reevaluating the Aquatic Management Strategy of the Northwest Forest Plan, researchers examined the potential impact to stream temperature as the result of thinning activities within riparian reserves of Bureau of Land Management holdings in Oregon. Modeling indicates that temperature increases and impacts to effective shade, wood recruitment and microclimate can be largely avoided if riparian buffers retain a width equivalent to or greater than one site potential tree height.

21) **Schuett-Hames, D., Roorbach, A. and Conrad, R. (2011) Results of the Westside Type N Buffer Characteristics, Integrity and Function Study Final Report. Cooperative Monitoring Evaluation and Research Report, CMER 12-1201, Washington Department of Natural Resources, Olympia, WA.**

Post harvest shade recovery was evaluated at 24 sites within five years after harvest. Eight sites were clearcut to the stream, thirteen had 50ft no-cut buffers, three received circular buffers with a 56-for radius extending from a perennial initiation point.

Within the 50ft. no cut buffer, shade was 76% a year after harvest. At clearcut sites, it was 12%. Shade levels at clearcut sites recovered to 37% 5-years after harvest.

Overall, retention of a 50ft buffer prevented most impacts from timber harvests. However, these buffers also saw a significant increase in tree mortality from wind damage when compared to pre-harvest conditions. Mortality rates exceeded 50% at three study sites that retained a 50ft buffer due to wind damage. At these sites, mean overhead shade was 30% lower than reference stands five years after harvest. The remaining 10 sites that received a 50ft buffer had mortality rates of less than 33%. At these sites, overhead shade was 10-15% less than reference conditions.

22) **Schuett-Hames, D. and Steward, G. (2018) Changes in Stand Structure, Buffer Tree Mortality and Riparian-Associated Functions 10 Years After Timber Harvest Adjacent to Non-Fish-Bearing Perennial Streams in Western Washington. Cooperative Monitoring Evaluation and Research Report, Washington Department of Natural Resources, Olympia, WA.**

One year after harvest, canopy closure, an indicator of shade from trees and tall shrubs, was lower at 50ft fixed buffer (76%) and 56ft circular buffers around perennial initiation points (52%) compared to reference researches (89%). By year 10, canopy closure at both treatment types was similar to that of the reference reaches, 85%.

At clearcut treatments, canopy closure was only 12% one year after harvest. However, it recovered to 72% by year 10.

Over the ten year study period, overall basal area increased in the reference stands while it decreased in the treatment buffers. This decline in basal area is likely due to increased tree mortality from windthrow events.

23) **Steinblums, I.J., Froehlich, H.A. and Lyons, J.K. (1984) Designing stable buffer strips for stream protection, Journal of Forestry, 82 (1), 49-52**

The study examined the effectiveness of 40 buffer strip treatments at retaining shade at different sites ranging from 2,000-4,000 feet in the Oregon Cascades. A regression curve was created to show the relationship between angular canopy density and buffer width. Overall, 80% canopy density was predicted to be achieved at buffers greater than 140ft wide.

Scientific Reviews

1) **FEMAT (1993) Forest Ecosystem Management: An Ecological, Economic and Social Assessment. Report of the Forest Ecosystem Management Assessment Team, Forest Conference, Portland, OR.**

The Forest Ecosystem Management Assessment Team (FEMAT) prepared 10 management recommendations to inform the creation of the Northwest Forest Plan. The primary goal of the report was to described a pathway for allowing for ongoing timber harvests while protecting and recovering late successional reserves to provide habitat for threatened and endangered species.

In order to maintain the habitat requirements necessary to support anadromous fish populations, the report recommends several key activities such as identifying key watersheds, protecting riparian reserves, restoring degraded habitat and minimizing road impacts as part of an Aquatic Conservation Strategy (ACS). Of the ten recommended management pathways, eight established riparian buffers of 300ft or two site potential tree heights (SPTH) from streams for fish bearing streams and 150ft or the distance of one SPTH from the stream for non-fish bearing streams. Seasonal streams were recommended to receive a 100ft or one SPTH buffer under these scenarios. Two options retained no protections for seasonal streams.

These buffer widths alongside other management recommendations are anticipated to provide between 60-80% cumulative effectiveness in regards to protecting a range of water quality and habitat benefits.

2) **Granger, P., Brennan, J., Culverwell and H., Gregg, R. (2009) Protection of Marine Riparian Function in Puget Sound, Washington. Sea Grant, prepared for the Washington Department of Fish and Wildlife, Seattle, WA**

This review evaluated a variety of existing research to determine recommendations for buffer widths to achieve 80% effectiveness in providing water quality, fine sediment control, shade, large woody debris, liter fall, slop stability and wildlife habitat. Those results are summarized in a chart. The average recommendation for each primary function are as follows:

- Water Quality: 109m
- Fine Sediment Control: 58m
- Shade: 24m
- LWD: 55m
- Litter fall: N/A
- Slope Stability: N/A
- Wildlife: 174m

3) **Leinenbach, P., McFadden, G. and Torgersen, C. (2013) Effects of Riparian Management Strategies on Stream Temperature. Science Review Team Temperature Subgroup, Seattle, WA**

In review of the scientific literature, the study found that minimal impacts were found to shade and stream temperature at clearcut sites with no-cut buffer widths of 46-69m. Studies suggest that most of this effect could be achieved with no-cut buffers of 30m, however, the studies are highly variable indicating the other factors such as groundwater interactions, canopy complexity and vegetation height which also influence shading capacity. Buffers less than 20m saw pronounced decreases in shade and increases in stream temperature. When thinning occurred in no-cut buffers, the effects varied greatly based on the intensity of the thinning and other site dependent factors. Overall, there is little studies to indicate the impacts to shade and stream temperature which occur when thinning harvests occur when compared to total canopy removals.

4) **Marczak, L.B., Sakamaki, T., Turvey, S.L., Deguise, I., Wood, S.L.R. and Richardson, J.S. (2010) Are forested buffers an effective conservation strategy for riparian fauna? An assessment using meta-analysis, Ecological Applications, Vol. 20, No. 1, pp. 126-134**

A meta-analysis of 397 reports, the study finds that overall, most buffer recommendations (average of 30m) do not maintain terrestrial species populations when compared to pre-harvest levels.

Often, terrestrial species are not invoked as a reason for establishing buffers as reserves after timber harvests. Therefore, consideration for their life histories is lacking in setting recommended buffer widths. Overall, birds responded best to disturbance that creates a riparian buffer. Mostly, this was to the benefit of edge dependent species. Populations of interior dependent bird species declined generally. Amphibian populations were also not protected by most riparian buffers. This was likely due to changes in microclimate and stream environment. Habitat response among small mammals was highly variable and species dependent. Some populations grew while others were heavily impacted.

Recommendations for establishing buffer widths to maintain pre-harvest communities of terrestrial fauna vary. However, narrow buffers show greater variability in terms of effects on total populations.

This suggests that buffers less than 50m are not sufficient to provide for the needs of a variety of species. Buffers substantially wider than what is required under most management practices may be required to provide adequate terrestrial conservation.

5) **Quinn, T., Wilhere, G. and Krueger, K. (2018) Riparian Ecosystems, Volume 1: Science synthesis and management implications, A priority habitat and species document of the Washington Department of Fish and Wildlife, Olympia**

Estimates the width of the riparian ecosystem to be one SPTH measured from the edge of the channel, channel migration zone or active floodplain. Protecting functions within this area is critical to maintaining high functioning riparian ecosystems. This estimate is based upon the original function curves determined by FEMAT which show that most of the cumulative effectiveness of root strength, litter fall, coarse wood debris to streams and shading can be accomplished within 1 SPTH.

6) **Spence, B.B., Lomnicky, G.A., Hughes, R.M. and Novitzki, R.P. (1996) An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR.**

This document serves as the technical basis for landowners to implement an ecosystem approach to habitat conservation planning for salmon recovery on nonfederal lands. A review of the literature suggests that protecting riparian buffers of approximately one site potential tree height (30-45m in most Pacific Northwest forests) are likely adequate to maintain 90-100% of key riparian functions such as shading, wood recruitment, liter fall, nutrient regulation and sediment control. However, this width may not be enough to protect all microclimate factors and larger buffers should be used if that is a management goal. The same is true in terms of wildlife habitat and buffers should be expanded as necessary to provide habitat that is suited for whatever specific species is targeted for management support.

Voluntary Certification Management Requirements.

1) **Salmon Safe**

   Salmon-Safe Inc. (2018) Salmon-Safe Urban Standards, Prepared by Herrera Environmental Consultants, Inc. Portland, OR.

   Salmon-Safe Inc. (2018) Salmon-Safe Certification Standards for Farms, Prepared by Herrera Environmental Consultants, Inc. Portland, OR.

   Salmon-Safe Inc. (2018) Salmon-Safe Certification Standards for Parks and Natural Areas, Prepared by Herrera Environmental Consultants, Inc. Portland, OR.

   Salmon-Safe Inc. (2018) Salmon-Safe Urban Certification Standards for Infrastructure Development, Prepared by Herrera Environmental Consultants, Inc. Portland, OR.

For farms, average buffers should be 50-100ft wide with a minimum width of 35 ft. Where slopes are greater than 10%, buffer should be no less than 50ft.

For infrastructure citing, buffers should be 200ft with minimal disturbance allowed within the 200ft riparian zone.

For parks and natural areas, 50ft buffer within minimal development, with the exception of trails, within 200ft of the stream channel.

For urban areas, minimized impacts within 200ft of the stream. No construction within the 100-year flood plain may be allowed to the greatest extent possible.

2) Forest Stewardship Council (FSC)

FSC (2010) FSC-US Forest Management Standard (v1.0), FSC-US, Minneapolis

The FSC Pacific Northwest regional standard applies a buffer of 50ft for all streams. An additional 150ft is added to all fish bearing streams and water supplies for a 200ft buffer.

For non-fish bearing streams, a 25ft no-touch buffer is applied along with a 75ft minimal touch buffer for a 100ft total buffer. For seasonal streams, a 75ft buffer is applied.

Kitsap Natural Resources Asset Management Program

Public Engagement Plan

January – April 2020

Project Summary

Background: Levels of service are used to measure how infrastructure is meeting the needs of the community. They can inform decisions related to management and maintenance of infrastructure. Developing levels of service requires a clear understanding of community expectations. This outreach and engagement process will serve as a starting point to develop levels of service for forests, streams, and marine shorelines in Kitsap County.

Purpose: Identify the ecosystem services that are a priority for Kitsap County communities to develop levels of service for forests, streams, and marine shorelines.

Desired Outcomes:

- Provide Kitsap County with a synthesis of community priorities regarding ecosystem services for the County to consider during level of service development
- Priority ecosystem services reflect the input and values of all Kitsap County communities to maximize community support and durability
- The engagement process identifies values people hold that inform how levels of service are determined and how to communicate them effectively

Guiding Principles:

A few guiding principles are listed for emphasis, but this is not an exhaustive list.

- Use a variety of strategies with multi-cultural considerations to ensure that methods are accessible to all communities of Kitsap County including tribal communities[1, 2]
- Consult with the intended audience during methods development to ensure accessibility[3]
- Provide adequate education about the project to ensure that participants can fully engage in the conversation[1, 3]
- Provide transparency in what the outreach process is for, how the information will be used and how much influence it will have on the final program[4]

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[1] https://www.epa.gov/sites/production/files/2015-02/documents/recommendations-model-guide-pp-2013.pdf

[2] https://www.seattle.gov/Documents/Departments/ParksAndRecreation/Business/RFPs/Attachment5%20_InclusiveOutreachandPublicEngagement.pdf

[3] https://www.ca-ilg.org/sites/main/files/file-attachments/beyond_the_usuals_8_15.pdf?1477947600

[4] https://www.fcgov.com/excellence/files/publicengagementguide.pdf

Project Overview:

Project Leads	Washington Environmental Council & Ross Strategic in partnership with Kitsap County Department of Community Development, Port Gamble S'Klallam Tribe and Suquamish Tribe
Scope	Outreach and engagement will be representative of all of Kitsap County ensuring there is space for experts working in natural resources management, tribal communities and the public to share their input
Engagement Level	Consult: At this level the project leads are asking for public opinion and considering the input when making decisions. Input is solicited at set points, but there is not necessarily an ongoing opportunity for input.[5]
Timeline	Methods development October-December 2019 Implementation starts January-April 2020

Implementation

Phase 1 - Presentations

Goal: Provide information and context about the project; advertise opportunities to provide input at the in-person workshops and through the survey

Timeline: Scheduling recruitment underway and dependent on external organizations availability. Aiming to have as many done as possible in February.

Materials: PowerPoint presentation, 1-pager, ecosystem service infographic, electronic recording of presentation for people that can't attend in person

- In person presentations at existing meetings
    a. Tribal community meetings- Port Gamble S'Klallam Tribe & Suquamish Tribe & Jamestown S'Klallam Tribe (Melia)
    b. Point No Point Treaty Council (Melia)
    c. Great Peninsula Conservancy (Lisa)
    d. Conservation District; WSU Kitsap County Extension (Melia)
    e. Hood Canal Coordinating Council (Melia)
    f. Environmental groups: Kitsap Audubon (Lisa), Earth Ministry (Lisa), Islandwood (possible) (Melia), Olympic College (possible) (Melia)
- Develop communications strategies and materials with WEC Communications team

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[5] https://www.epa.gov/international-cooperation/public-participation-guide-selecting-right-level-public-participation

Phase 2 - In-Person Workshops:

Goal: gather input on priority ecosystem services that will then be used to structure the survey

Timeline: Throughout March

Materials: Dependent on structure

- 2 half-day workshops
  - Location to be determined (i.e. natural resources office, county offices, community center, etc.)
  - Structure to be developed in partnership with Ross Strategic
  - Audience based on interest generated at presentation and from initial stakeholder list

Phase 2.2 - 1:1 Interviews with select individuals

Goal: Incorporate input from select individuals that are invested, more accessible in person and where workshops may not be the appropriate platform for gathering input

Timeline: Throughout March
Materials: To be shaped with tribal partners (i.e. blurb about WEC, informational materials, interview questions)

- Work with core partners to identify priority individuals such as elders to conduct 1:1 interviews with

Phase 3 - Survey

Goal of survey: Refine information gathered at workshops and 1:1 interviews about priority ecosystem services; rank priority ecosystem services to help inform level of service development

Timeline: Throughout April

Materials: Survey platform

- Online surveys
- Structure of survey to be developed based on workshop results
- Optional: Electronic survey booster such as an online Town Hall or a short recording about the project and then link to the survey